GAS JOURNAL, FEB. 5, 1947

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GAS INDUSTRY AND THE COKE OVEN INDUSTRY

IN our issue this week we start a series of articles which, we think, has high significance. There must be a far closer understanding of the common requirements and the relative techniques of the processes employed by the Gas Industry and those used by the Coke Oven Industry. On the manufacturing side, the Coke Oven Industry knows much, though it has been, to a very large extent, isolated in former years from the Gas Industry. But the Gas Industry has, through years of experience, gained a wide knowledge of distribution and utilization problems which the Coke Oven Industry knows little about. The coke ovens attached to collieries have been nationalized. There is probability that the Gas Industry, within the next few years, will be nationalized also. It is clear that integration between the two industries will be essential to the welfare of the community. We envisage more centralization of gas production in relation to population requirements. Several of the small units in the Gas Industry which now exist are, in fact, incapable of taking up fluctuations in load which are likely to become far greater in the future unless steps are taken towards levelling them up. The tree of the carbonizing industry contains two major branches, comprising the Gas Industry and the Coke Oven Industry, and the small branch is the Low Temperature Carbonization Industry. The two big branches are, from the coal consuming point of view, of approximately equal strength, each taking a supply of coal of about 22 million tons a year. Both industries could take more than this quantity were the coal available, but the constitution of the two main branches differs in an important respect. In the Gas Industry, the coal treated is divided between about 1,050 undertakings, whereas in the Coke Oven Industry a total of somewhere around 96 units handle the same quantity of raw material. Even the smaller size of coke oven plant, carbonizing 2,000 tons of coal each week, would in effect be large enough to supply the present gas requirements of such towns as Oxford, York, or Stockport. The average size coke oven plant of 4,000 to 6,000 tons capacity per week would constitute a large gas-works.

Of the very great number of producing units in the Gas Industry, about 700 have an annual output of under 500,000 therms each and only about 100 undertakings have an annual output exceeding 2½ million therms. With coal yielding 75 therms of gas per ton an annual output of 2½ million therms would mean the carbonization of 630 tons of coal per week, assuming that the plant had to maintain a steady output throughout the year.

As gas engineers well realize, steady conditions of gas output are impossible of achievement in practice. Plant has to be maintained to meet variation in load between summer and winter and repairs have to be carried out to maintain the plant in good condition. Throughout the war years, plant in general on gas-works has, through no fault of the Gas Industry and through no fault of any particular gas undertaking, arrived at a stage where repairs are essential and where materials for such repairs are not forthcoming—and this is one of the primary reasons why consumer service cannot be perfect. The Coke Oven Industry has not had to deal to any extent with great variation in load and its policy has been based on the production of solid smokeless fuel, which can be stored until the demand arises for its use. We feel that the Gas Industry and the Coke Oven Industry should, by mutual effort, discuss and determine a long-view policy, and that is the purpose of the articles which we intend to present to our readers.

CONFIDENT ANTICIPATION

WE leave January, 1947, from the point of view of weather and exasperation, without qualm. It is no fault of the gas undertakings who have had to reduce pressure beyond statutory limits and who have tried to the best of their ability to meet the phenomenal increase in demand due to the coal not being available to meet the requirements of the community. This is the source of the evil. The weather has been inclement and intemperate and we are given to understand that comparisons can only be made with conditions of 30 years ago. Inadequacy to fulfil the demand for fuel and light has seriously inconvenienced most people in the British Isles. It has meant in several areas a cut to the extent at certain times of 100% in electricity, and gas undertakings throughout the country have had severely to reduce pressures. The Gas Light and Coke Company, whose activities in the matter of anticipating the demand are the basis of the present note, had to enforce on occasion a cut of 25%, the South Metropolitan 40%, Wandsworth 20%, South Suburban 30%, Lea Bridge 20%, North Middlesex 50%, and Hornsey 30%. The effect upon the well-being of the community has been marked and it must become the subject of serious concern to the Ministry of Fuel and Power to try during the coming months to attempt a solution to a problem which, if not dealt with, may well occur again.

Our recent editorial comment on the value of degree days and their application to the factors governing gas supply

have aroused interest in many quarters. Perhaps this interest has been heightened by the severe cold of January, which has accentuated the importance of all measures of preventive planning, or in other words, looking ahead. We have suggested in these columns that when the Gas Industry is divided into larger and more balanced regional units, the forecasting of probable gas consumption by accurate and frequent meteorological reports would be of great service in determining how best to meet forthcoming demands. The need for the adoption of some such measure is apparent. We would like to mention here, however, the adoption of the idea and its successful practical application by the world's largest gas undertaking. For the past seven years the Gas Light and Coke Company has organized and regulated its production and distribution from a central control room. Hourly contact is maintained with the 12 works and 18 holder stations, who report their stocks and the amount of gas manufactured in the previous hour. Working conditions at each station are noted, together with details of plant operation. Thus the gas production in the past and in the present for each works in the Company's area can be seen at a glance and future demands predicted. The advantages of such a system are broadly these: By means of the grid system now in operation, allowing a high degree of flexibility, estimated times for repairs to any of the works supplying the grid may be planned well ahead, and the deficiencies incurred balanced, if needed, by the increased production of other plants.

A check on production and stocks is kept constantly up-to-date, but the factor of estimated consumption remains. By means of regular weather and temperature reports from the Meteorological Office and from special equipment at the Company's Fulham works (by the way, the two coincide markedly), the consumption can be estimated with astonishing accuracy. This accuracy was made clear to us when we visited the Company's control room a few days ago. The deviation between the estimated and the actual consumption figures was slight and it was seldom that consumption was in excess of the prophesied amount.

The advantage of this estimate, coupled with the information on hand, enables a complete plan of action to be drawn up with confidence; it is not guess-work. The success of the system depends on three factors: the availability of accurate weather reports—and we understand the B.B.C. has in this regard co-operated fully; the degree of flexibility obtainable on the grid; and whole-hearted collaboration on the part of every works. It is this last point we wish to emphasize. There is still lack of cohesion in the Industry, a number of left hands who know not what their right hands are doing. The success of the Gas Light and Coke Company's scheme lies in teamwork, and the example thus set is one which may well be profitably followed.

GASHOLDER PURGING

WAR risks resulted in an increased appreciation of the importance of preventing the direct admixture of air and combustible gas at any time during the replacement of one by the other, in order to avoid the possibility of explosion. Gasholder purging had already been practised for some 30 years, but the incidence of war damage required the exercise of much ingenuity in the improvising of rapid and unorthodox methods. A much wider experience of the practice is therefore now available for discussion than existed six years ago, and for that reason the Paper on "The Purging of Gas Plant and Holders" which Mr. L. Silver, of the Gas Light and Coke Company, gave to the Southern Association of Gas Engineers and Managers (Eastern District) on January 28 was of outstanding interest.

One of the most valuable features of the Paper was the Author's clever and ingenious graphical device for measuring the limits of explosibility of mixtures and the application of the Le Chatelier principles for the determination of such limits with quite complex mixtures of gases. Of up-to-date interest, too, was the description of the application to the purging operation of the use of carbon dioxide in cylinders. A final section comprised a clear and concise code of practice which deserves to be consulted by all who have to undertake the purging of any kind of gas plant.

The discussion, confined though it was to but a few speakers, was of no less significance than the Paper, in that it elicited accounts of actual experiences in two of the largest undertakings, and brought out the fact that it was Dr. Lessing who, in a letter to the *Journal* just over 37 years ago, first advocated the use of inert gases for the promotion of safety in purging. Many years passed before his suggestions were acted upon, and then the first development was in America, to which country we owe the origin of the Harrison purging machine which has been so extensively used in this country in later years.

A merciful providence seems to have looked after the interests of gas undertakings in the century before safety precautions were taken, and in more recent times it would appear that it has only been as a result of some actual or threatened catastrophe that whole-hearted interest has been aroused in the attainment of anything approaching complete safety. At the Autumn Research Meeting of the Institution of Gas Engineers 10 years ago, Mr. F. M. Birks, now Deputy Governor and Managing Director of the Gas Light and Coke Company, presented a Paper on the use of the Harrison purging machine, and as Mr. Silver mentioned in his recent Paper the discussion revealed that even at that comparatively recent date there was still some division of opinion among gas engineers on the necessity for purging with inert gas when putting holders into or out of commission. Purging, however, in many more senses than one, has been very extensively applied throughout the world since Hitler first applied it in political circles, and in the sphere in which we are more particularly interested, its value as a safety measure is never again likely to be overlooked.

THE CONJOINT CONFERENCE

WE reported in last week's issue of the "JOURNAL" the Annual Meeting of the Conjoint Conference of Public Utility Associations, over which the President, the Viscount Falmouth, presided. For many years the Conjoint Conference has acted without publicity and, to a large extent, behind the scenes in the many matters in which gas, electricity, water, and, where appropriate, light transport, have identical interests. When the Conference was constituted in 1925 its activities were mainly restricted to negotiations with highway associations regarding the use of highways by public utility undertakers. In those days, generally speaking, when highway reconstruction necessitated the removal of subsurface apparatus, it was nearly always the public utility which had to foot the bill, although the necessity arose from the action of the highway authority. The desire to remedy what appeared to be an injustice led to the co-operation of the gas and water interests, which were subsequently joined by the electricity associations. The fruits of co-operation were rapidly appreciated and extended to many other subjects, the wide range of which is amply illustrated in the Annual Report of the Conference for 1946.

Hardly any Bill is introduced into Parliament to-day which does not affect directly or indirectly the interests of public utility undertakers, and in the vast majority of such cases it is possible and, for obvious reasons, eminently desirable that those interests should act together. This co-operation has come about through the medium of the Conjoint Conference, and in the face of the natural, normal, and healthy competition of the Gas and Electricity Industries in the commercial field. There can be little doubt that the original formation of the Conference was due to a large

extent to the vision and foresight of Lt.-Col. Sholto S. Ogilvie, who, from its inception, had been a Joint Hon. Secretary of the Conference until his retirement in June, 1946.

It was appropriate, therefore, that at a luncheon following the annual meeting, Lord Falmouth should have presented Colonel Ogilvie, on behalf of the Conference, with his portrait painted by that eminent portrait painter, Mr. Frank Salisbury. The representative gathering attending the luncheon was an indication of the wide interest taken in the activities of the Conference, and of the appreciation of Colonel Ogilvie's work and character.

It is satisfactory to know that Lord Falmouth, who, since 1939, has been President of the Conference, was unanimously re-elected to that office, and that during the difficult year which lies ahead his wise leadership and impartial counsel will be available. It is also satisfactory to know that Mr A. E. Sylvester, although unfortunately obliged to resign from so many of his offices, has consented to continue as one of the Vice-Presidents of the Conference.

The Chairman of the Council of the Conference is elected annually from the gas, electricity and water interests in rotation, and the Conference has been particularly fortunate in the calibre of the various gentlemen who from time to time have consented to act as Chairman of the Council. In more than one case the Chairman nominated by one interest, at the expiration of his year of office, has been requested by one of the other interests to continue as Chairman during their period of nomination.

Uncertainty as to the future of the Conference was felt by many to cast a shadow upon its proceedings, and Lord Falmouth in his Presidential Address indicated that it was unlikely that the Conference could, in its existing form, continue after the nationalization of the electricity, gas, and transport interests. While this may be so, it is difficult to believe that in the future there will be no co-operation between the interests at present represented by the Conference. Many of the problems in which the Conference has acted in the past will still be in existence. Whether the Gas and Electricity Industries are in private ownership or have been transferred to some Public Corporation, they will nevertheless have to deal with highway associations, town and country planning authorities, the revenue, rating authorities, and a host of other bodies in respect of matters in which their interests are identical.

A nationalized Central Electricity Authority or Central Gas Board would, of course, both be under the Ministry of Fuel and Power, but it is scarcely conceivable that the Ministry would be prepared to intervene in many of those matters with which the Conjoint Conference has dealt in the past. Further, the water industry, which is not threatened with nationalization, is outside the ægis of the Ministry of Fuel and Power, and if their co-operation were required, some special machinery would have to be devised.

Whatever may be the future, the Conference has a proud tradition of service behind it. Throughout, it has upheld the characteristically English tradition that competition, however, intense, need not eliminate useful co-operation where identical interests are threatened. Such co-operation has evolved a bond of personal trust and understanding which may well survive the changes which lie ahead

Coventry and Birmingham Link

Subject to approval by the City Council, a 25 years' agreement is to be entered into between the Coventry Gas Department and the City of Birmingham Gas Department, whereby Coventry will supply Birmingham with a minimum of 1,000,000 cu.ft. of gas per 24 hours, and a minimum of 500,000,000 cu.ft. per annum. The total length of the proposed 12 in. high pressure main is approximately 13 miles; and the gas will be metered and governed on the joint boundary of the two undertakings, which is approximately mid-way along the route of the new main. The approximate cost of the total scheme is £95,000, and each undertaking will bear the cost of such portion of the main as comes within its area of supply. It is of interest to note that the Birmingham undertaking is making a considerable quantity of gas available to the Smethwick, West Bromwich, Oldbury, Dudley, and Bromsgrove undertakings, and that therefore the Coventry supply will in some measure offset these loads. Quite apart from the immediate usefulness of the scheme, there is considerable scope for both undertakings to secure new gas loads *en route*, and in certain portions of their respective statutory areas of supply not yet adequately served.

Headache in Tokio

A news item in a recent issue of the "JOURNAL" to the effect that the Tokio Gas Company are charging their consumers a penalty rate 10 times the normal cost for all gas used in excess of the daily ration, has played tricks with our imagination. We visualize the cultured gentleman who, gently waving his fan of ivory-tipped peacock's feathers, sits lost in meditation on his balcony, overlooking the fragrant valley lost in a mist of pink and white blossom. He is a connoisseur. He keeps the delicate silk pictures of Hi Tuang on the perfumed walls of his study; he quotes Chao Lin, Li Hou-chu, and Meng Chiao with a soft musical intonation unequalled by the fountain which plays in the fore-court of his palace; when he dines his appraising palate is smoothed with the sweetness of the traditional 27 courses. We can imagine then his horror upon examining his dwindling coffers to find that his feast must be reduced to but 18 courses because the illustrious gas company has increased the price of its honourable gas. Perhaps, if he is wise to the folly of men, he will have heard of a certain inaccurate and tawdry parody upon the glory of the East by the barbarians of the West, and will appreciate the force of the lines which may be applied to the gas company which "made the punishment fit the crime." Certainly his ancestors never had to cope with this.

Diary

Feb. 7.—London and Southern District Junior Gas Association: "Some Investigations on Leakage from Distribution Systems," C. D. Shann. Gas Industry House, 7 p.m.

Feb. 10.—London and Counties Coke Association: Technical Committee, 2.30 p.m. Gas Industry House.

Feb. 11.—Midland Junior Gas Association: "The Engineer and the Accountant in the Gas Industry," R. Thompson, Bilston.

Feb. 11.—National Federation of Gas Coke Associations: General Committee, 10 a.m. Gas Industry House.

Feb. 11.—British Council: Central Executive Board. Gas Industry House, 2.30 p.m.

Feb. 12.—Manchester and District Junior Gas Association: Visit to Works at Trafford Park. Paper, "Industrial Gas," T. H. Pardoe (Stretford).

Feb. 14.—National Federation of Gas Coke Associations: National Technical Committee, 10.30 a.m. Gas Industry House.

Feb. 14.—Joint Consultative Committee (Domestic Development Committee and Society of British Gas Industries), 2.30 p.m. Gas Industry House.

Feb. 16.—Midland Junior Gas Association: Visit to the Keresley (Coventry) Colliery of the National Coal Board.

Feb. 17.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m. Gas Industry House.

Feb. 19.—B.G.C. Domestic Development Committee, 2.30 p.m. Gas Industry House.

Feb. 20.—Institute of Fuel (North Western Section). "Review of the Work of R/16 Committee," Dr. E. G. Ritchie. Radiant House, Bold Street, Liverpool, 2.30 p.m.

Feb. 22.—Yorkshire Junior Gas Association: Paper by E. S. Carter, Distribution Superintendent, Halifax Gas Department. At Bradford.

Feb. 25.—Southern Association of Gas Engineers and Managers (Eastern District): "Load Development and Distribution on the Adcot Company's Gas Supply Area," J. W. Kaye. Gas Industry House, 2.30 p.m.

Feb. 27.—Midland Junior Gas Association: Visit to British Refractories Research Association's Laboratories, Stoke-on-Trent, 2.30 p.m.

Mar. 5.—London and Southern District Junior Gas Association: "Technical Chemical Control of Gas-works," S. G. Vane. Gas Industry House, 2.30 p.m.

Letters to the Editor

A Matter of Paint

DEAR SIR,—Your editorial comments on Mr. C. A. Poulson's Paper in your issue of Jan. 1, 1947, regarding the appearance of gas-works plant prompts me to suggest that gas engineers should give their critical attention to the painting specification they issue to contractors. I think they may find in many cases the specifications have been copied year after year without much thought being given to bringing them in line with modern knowledge and practice. I have noticed that some specifications are particularly lacking in instruction with regard to the preparation of steel surfaces for painting, implying misunderstanding of the condition of the surfaces of steel plate, &c., as received from the mills and of the disadvantages of applying paint or oil to surfaces from which millscale has not been removed.

To assist engineers readily to appreciate the work which has been done on the subject of painting, I would recommend a study of the brochure published in 1941 by the Iron and Steel Institute entitled "Protective Painting of Structural Steel" and their Special Report No. 31 by F. Fancutt entitled "The Effects of Different Methods of Pretreating Iron and Steel Before Painting." They are essentially practical and will help engineers to "brush up" their painting specification.

Yours faithfully,

G. H. CHALLIS.

Whessoe, Ltd.,
Darlington.
Jan. 29, 1947.

Home Fire

DEAR SIR,—We have received a cutting of a leading article in the "GAS JOURNAL" of Jan. 15, in which you discuss our recent leader, "Home Fire." In the course of your remarks you say: "It is to be noted that there is very little emphasis on efficiency in coal economy in all this. There is no realization of the fact that the Englishman 'shivers on the stairs' (not to mention in the bedroom) when his American cousin is comfortably warm all over the house, and that for no more expenditure of fuel."

This is a puzzling comment; the whole argument of our article was that indoor comfort in winter demands space-heating of some kind. For instance, we remarked that "in really cold countries no one relies on the open fire . . . it is recognized that a comfortable winter dwelling must have a warm climate all through"; and we added that "this is the only way of avoiding those painful transitions—dreaded by visitors to Britain—from the cosy circle round the fire to icy bedrooms and freezing corridors."

As for fuel economy, we said early in the article that Britain's former abundance of coal has made her "the most wasteful user of domestic heat," and that open fires "are a very inefficient way of warming houses."

I feel that your leader, though I am sure it was well-intentioned, gives a misleading impression of ours, presenting it as largely a sentimental rhapsody on the open fire, which it quite obviously was not.

Yours faithfully,

CHARLES DAVY,
Assistant Editor.

The Observer,
22, Tudor Street, E.C.4,
Jan. 29,1947.

(We assure our correspondent that our editorial comment in question was "well intentioned," and we appreciate the general tenor of his letter.—Ed., "G.J."

Oil for Gas Making

DEAR SIR,—To avoid the great dangers which would result from a widespread breakdown in the gas supply due to the possible failure in keeping gas-works supplied with coal, the undersigned suggests that the Gas Industry should forthwith adopt the following policy:

To make and supply approximately 50% each of coal gas and carburetted water gas, while maintaining present calorific values. To facilitate this and prevent greatly increased costs of gasmaking, generous subsidies should be granted to undertakings to cover excess cost of oil for water gas plant. For this purpose it is assumed that coke oven gas supplied to gas undertakings would remain unaltered.

There is good reason to believe that sufficient carburetted water gas plant exists in the gas-works of England, Scotland and Wales to enable such a policy to be carried out. Apparently, Messrs. Humphreys and Glasgow alone have installed plant of a daily capacity of 700 million cu.ft. of carburetted water gas in the British Isles, excluding Ireland. Further, other builders of such plant have, it is estimated, installed a further 10%, making in all a daily capacity of approximately 770 million cu.ft.

If we assume that in 1947 there will be, or ought to be, supplied 15% more gas than in 1945, figures for which year have been published, then the average daily make of gas, exclusive of coke oven gas supplied to gas-works, would amount to 1,200 million cu.ft.

From the above figures it would appear that, after allowing a good margin for plant in bad condition, there should be enough workable carburetted water gas capacity to meet the above requirements in a practical way during the greater part of the year. It may be thought that there would have to be a wide difference in the proportion of coal gas and carburetted water gas between summer and winter. It is probable, however, that this would not be so in most cases. For instance, if we assume that the 41 Companies in the Severn Valley and Gas Consolidation Group are typical of the average of the country, the difference in the gas demand is as follows:

In the past 12 months there was during the five winter months —November to March inclusive—an average monthly send-out of 804 million cu.ft., while for the seven remaining months the average was 697 million cu.ft. per month.

Of the 1,065 gas-works in England, Scotland and Wales, 250 make 90% of all the gas, and it is these which to a very large extent have the water gas plant capacity to which reference is made above. The remaining works could make a small contribution only to such a scheme as outlined.

The result in round figures for a year's working would appear to be approximately as follows:

(1) 16 million tons of coal would be used instead of 24 million tons, which latter figure represents 15% more coal than was used in 1945.

(2) 4 million tons of coke would be used for making carburetted water gas.

(3) 1 million tons of oil would be used for making carburetted water gas; and

(4) doubtless about 3.2 million tons of gas coke would be available for sale to users.

It would be very regrettable that so much less coke would be available for sale, but it would seem to be the lesser of two evils. The dislocation of supplies to coke users would be outweighed by the two definite advantages of the scheme—viz., the assurance of adequate supplies of coal to the Gas Industry and a reduction in the cuts in coal supplies to industry generally.

It is, of course, a thousand pities that the Gas Industry, which, like the coke ovens, uses coal with the highest efficiency of all industries, should be cut down on its own consumption of coal. But it so happens that it can in many works use oil instead of coal to make gas, although with a marked reduction in efficiency. Accordingly, in these days of great coal shortage, it seems clearly to be the right thing to do.

Yours faithfully,

G. M. GILL.

Severn Valley Gas Corporation, Ltd.,
Gas-works, Cheltenham.
Jan. 27, 1947.

1947 "Journal" Directory

In order to keep the Directory information up to date, the following alterations and corrections which have been notified during the past month should be noted in the 1947 issue of the "JOURNAL" Calendar and Directory:

Page 6.—ABERTILLERY. D. S. Davies, *E., M. and S.*, vice D. Thomas.
" 10.—BARNARD CASTLE.—H. R. Iawton, *M. and S.;* delete J. Audas, *S.*
" 10.—BARNOLDSWICK.—H. Spencer, *E. and M.*
" 18.—CARDIFF.—R. J. Auckland, *Dir. and M.;* T. A. Morgan, *S.*
" 36.—HAYWARDS HEATH.—A. E. Witcher, *M.D.*, retired; S. H. Cox, *E. and M.;* H. Orchard, *S.*
" 46.—LLANELLY GROUP.—GOWERTON: A. Pickard, *E. and M.;* E. Smith, *Asst. E.;* I. J. Ferris, *S.;* W. T. Lloyd, *Works and Distrib. Supt.* LLANELLY: A. Pickard, *E., M. and S.;* E. Smith, *Asst. E.;* I. J. Ferris, *Acct.;* T. D. Barker, *Dist. E.*
" 58.—PORTHCAWL.—D. S. Davies, *M.*, resigned.
" 60.—RAUNDS.—See Rushden.
" 62.—ROTHWELL.—A. Smalley, *M.*, resigned.
" 62.—RUSHDEN (now Rushden District Gas Company).—W. D. Bates, *S.*, vice F. Craddick, resigned.
" 68.—SOUTH SUBURBAN.—T. Brown, *M.D*, Price of gas, 15.65d.
" 90.—EDINBURGH.—D. D. Melvin, *E. and M.*
" 90.—GLASGOW.—D. D. Burns, *Gen. M.*
" 139.—VICTORIA, B.C.—Sales, 372 million cu.ft.; C.V., 461; Consumers, 7,264.
" 141.—IMPERIAL CONTINENTAL GAS ASSOCIATION.—C. S. W. Harris, *Asst. M. and S.;* W. N. Devonshire, *Asst. S.*
" 149.—LEEDS (Public Lighting Engineers).—L. A. Doxey, *Street Lighting Engineer.*
" 157.—BRITISH GAS COUNCIL.—A. E. Sylvester, *Pres.;* Colonel H. C. Smith, *Ch.*
" 157.—SOCIETY OF BRITISH GAS INDUSTRIES.—D. Rider, O.B.E., *Vice-Ch.;* M. W. Burt, *M. and S.*
" 158.—WOMEN'S GAS COUNCIL.—Mrs. G. Abbott, *Organizing S.*, resigned.

Personal

Mr. F. BACKHOUSE has joined the staff of Cowper Penfold & Co., Ltd., and will represent the Company in the Lancashire and Yorkshire area.

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Mr. WILLIAM E. BLAKENEY, Solicitor, of Plymouth, has been elected a Director of the Plymouth and Stonehouse Gas Light and Coke Company.

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Mr. G. FORNACHON, Deputy Engineer and Manager of the Colne Gas Department, has been appointed Assistant Works Superintendent at the Basford works of the Nottingham Gas Department.

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The Directors of South-Eastern Gas Corporation, Ltd., have appointed Major the Rt. Hon. GWILYM LLOYD GEORGE, M.P., to fill the vacancy on the Board caused by the resignation of Mr. Henry Woodall.

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Mr. L. W. JARRETT, of the Gas Light and Coke Company, has been appointed Works Engineer to the Cambridge University and Town Gas Light Company. Mr. Jarrett gained the diploma in Gas Engineering (Manufacture) of the Institution of Gas Engineers last year.

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Mr. ERNEST W. KING, a Director of Robert Dempster & Sons, Ltd., Rosemount Ironworks, Elland, who has been Senior Technical Representative for 18 years, has resigned his position with the firm and the Directorate. Mr. EDWARD J. KING, his father, still remains on the Board.

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Mr. J. WEBSTER, Engineer and Manager of the Lockerbie Gas Department, has been appointed Engineer and Manager at Burntisland, in succession to Mr. D. Marshall, who was recently appointed Deputy Engineer at Paisley. Before going to Lockerbie Mr. Webster was Assistant Engineer at Port Glasgow.

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The staff and employees of the Rochdale Gas Department were the guests of Alderman A. ASHWORTH, Chairman of the Gas Committee, at a social evening to mark his 70th birthday. He was the recipient of birthday gifts from the Gas Department, handed to him by the Mayor, Councillor N. R. Woolfenden, and from the Transport Department, presented by Alderman Scarr.

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Mr. HORACE B. J. HART, Deputy Engineer and Manager since 1939, has been appointed Engineer and Manager of the Shipley Gas Department in succession to Mr. H. Burton, who retired on Dec. 31 after 28 years' service. Mr. Hart commenced his training with the Chester United Gas Company in 1926, and was appointed Works Chemist to the Company in 1930. He became Technical Assistant at Shipley in June, 1939, and was promoted to the post of Deputy Engineer and Manager in November of the same year.

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Mr. S. BROUGHTON, A.C.A., has been appointed Managing Director of Electrolux, Ltd. He succeeds Mr. J. SCRIVENER, the present Vice-Chairman, whose activities as the Company's original Managing Director are well known. Mr. Broughton has been associated with Electrolux, Ltd., for 20 years. He joined the staff in 1933 but prior to that, as a Chartered Accountant, he was on the staff of the Company's Auditors. His knowledge of the workings of the Company is a practical one because he has officiated as controller of their internal audit and hire purchase accounts, Assistant to the Managing Director, Manager of Export Sales, Assistant Secretary, and Secretary. The new Secretary of the Company will be Mr. M. AITKEN, F.C.I.S., whose business life of over 20 years has been spent with Electrolux, Ltd.

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Mr. HENRY WOODALL, Chairman of the Danish Gas Company, has resigned from the Board for reasons of health. Mr. Woodall joined the Board in 1916 following the death of his father, Sir Corbet Woodall, and became Chairman in 1934. During the summer of last year he thus completed 30 years as a Director, and the occasion evoked many expressions of the affection and high regard in which he was held by colleagues and employees from the highest to the humblest. Mr. Woodall served the Company during the difficult period of reconstruction which followed the first Great War. The severance of connexions with Denmark during the last war brought about the complete break-up of the internal structure of the Company. The restoration of the organization on its traditional footing was his chief concern during the last 18 months and this achieved, he leaves the Company with the gratitude and good wishes of all who have been associated with him. Mr. Woodall's son, Lieut.-Colonel EDWARD C. WOODALL, O.B.E., has been elected as the new Chairman. Colonel H. C. SMITH, C.B.E., has been appointed to fill the vacancy on the Board.

Sir ERNEST WOODHOUSE SMITH, C.B.E., has been elected to the Board of Directors of Romford Gas Company.

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Mr. J. S. WOOD, who has been many years with the Davis Gas Stove Co., Ltd. (Radiation, Ltd.), and who is a grandson of Mr. Henry Davis, the founder of the Company, has been appointed Sales Manager in succession to the late Mr. F. H. Swain.

* * *

Dundee Lord Provost's Committee has decided to retain the services of Mr. J. DICKSON, Gas Engineer and Manager, for three months beyond his retiral date. "He is well contacted in all supply centres," said Gas Convener Douglas, "and it would be wrong to request his retiral at the present time."

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At a recent meeting of the Board of the Cheltenham and District Gas Company the following staff appointments, with effect from Jan. 1, were confirmed: Mr. S. VERNON appointed Accountant, and Mr. M. R. WEBB Commercial Assistant to the Company, also Secretary to Campden Gas Company, and Bidford-on-Avon Gas Company (constituent companies of Severn Valley Gas Corporation, Ltd.). On the distribution staff the following appointments have also been made: Mr. F. H. WATTS as Distribution Manager's Assistant (Fittings), and Mr. R. E. POCKETT, Distribution Manager's Assistant (Mains).

* * *

Mr. ALEC WEBSTER, M.Sc., M.I.Chem.E., A.R.I.C., of the Technical Staff of the Royal Naval Propellent Factory, Caerwent, near Chepstow, has been appointed Safety Officer for the Association of British Chemical Manufacturers. The Works Safety Committee, under the chairmanship of Mr. H. R. Payne, has drawn up a programme of work which is expected to take five years to complete. Prominence is being given to the revision of Part I of the Association's Model Safety Rules for use in Chemical Works (which is now nearly complete), the completion of a "text book" of chemical safety in the shape of Part II of the Rules, and the revision of methods for the detection of toxic gases in industry. Mr. Webster will take up his duties about the end of this month.

Obituary

The death is reported of Mr. G. H. BROUGHTON, who had been Chairman of the Ilkeston Gas and Lighting Committee for some years. He was Mayor in 1932-33, and was 77 years of age.

* * *

Mr. J. M. O'HANLON, on the staff of the Newcastle and Gateshead Gas Company for 40 years, has died at the age of 60. Mr. O'Hanlon who was one of the pioneers of the Home Guard movement in Wallsend, was a son of the late Alderman John O'Hanlon, a former Mayor of Wallsend.

* * *

Mr. GEORGE KEILLOR, grandfather of Mr. R. D. Keillor, Engineer and Manager of the Greenock Gas Department, died at Coldstream on Jan. 25 after a short illness while on a visit to his youngest son, Mr. Alex. Keillor, Engineer and Manager of the Coldstream Gas Company. Mr. G. Keillor was in his 94th year and in his active life worked as a mason, then as a gas engineer, ultimately becoming owner-manager of Comrie Gas-works. He was also a qualified architect and carried out a large number of civil engineering and large-scale central heating projects, including a hydro-electric installation for a Perthshire estate. Other members of the Keillor family associated with the Gas Industry included the late Mr. George Keillor, a former Greenock Gas Manager, Mr. John Keillor, recently retired Manager of the Vancouver gas undertaking, and Mr. George Keillor, recently appointed Engineer and Manager of the Airdrie Gas Department. A keen musician Mr. Keillor played the violin in the Edinburgh Philharmonic Orchestra when over 80 years of age.

The Five-day Working Week has been adopted by R. and J. Dempster, Ltd., Manchester, and Westwood and Wrights, Ltd., Brierley Hill. In both cases the offices and works will in future be closed from Friday evening until Monday morning.

Dunfermline Dean of Guild Court has granted a petition by Dunfermline Town Council for the erection of a four million cu.ft. per day water tube condenser at the Corporation gas-works, at a cost of £4,690.

News in Brief

Gas is to be Supplied by the Middlesbrough Gas Department to the proposed trading estate in South Park Road at a cost of £2,045.

For Relief of the General Rate the Darlington Corporation Finance Committee is planning to take £20,000 from the funds of the Gas Department.

Glasgow Corporation proposes to hold a Scottish Fuel Efficiency Exhibition in conjunction with the conference of Light, Fuel and Power Appliance Manufacturers, in the Kelvin Hall, Glasgow, from Mar. 24 to 27 next.

The British Chemical Plant Manufacturers' Association, 26, Portland Place, London, W.1, has issued the "B.C.P.M.A. List of Members and Classified Index of Products" pending the publication of "British Chemical Plant, 1947-48," which will be illustrated. The present interim list is a brochure of 44 pages.

Bradford Householders, including Mr. G. E. Currier, Gas Engineer and Manager, in the Sandy Lane district of Bradford, just within the boundary on the Bingley side, were without gas for several hours on Wednesday of last week, because of a local pressure controller freeze-up. All gas users in the district were warned to turn off taps. The supply was restored between 6 and 7 p.m.

Gas Pressure in Manchester, during the severe weather last week, was reduced to a quarter of normal, and in many districts housewives found it difficult to cook over the flickering gas flame. At 8 o'clock on Wednesday evening, the total stock of gas in the Manchester gasholders was only 2 million cu.ft., as against the normal 15 million cu.ft.

Continued Heavy Demand for gas is reported by Mr. A. Harrison, Manager of the Accrington District Gas and Water Board. A recent failure of plant at Oswaldtwistle reduced the supply from that source by 45 to 50%, but the Great Harwood plant has been restored from 75 to 80% capacity. A scheme is to be submitted to the Ministry of Fuel and Power for improving gas distribution by replacing an old main from Great Harwood to Accrington by a high pressure main.

General Purpose Jointing Materials for gas-heated domestic appliances and gas installation pipes are the subject of a newly issued British Standard Specification, B.S. No. 1337. The specification provides for a resilient, general purpose jointing material which is non-adherent to joint faces, and re-usable. Tests for hardness, accelerated ageing, cracking, porosity, resistance to steam, swelling in benzole, and resistance to acid are given. Copies may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, S.W.1, price 2s.

An Increase in the Allocation of Coal stocks to the Folkestone Gas Company has been made by the Minister of Fuel and Power as a result of representations made by the M.P. for the district. From Jan. 20 the allocation has been increased to 680 tons per week. An official of the Company stated that if the supply is maintained it would probably see them through their difficulties. The Company had been allocated 500 tons weekly, but to maintain supplies and ensure a reserve they required a weekly allocation of 630 tons in mild weather and 690 tons in cold weather.

During the Past Six Weeks a 20 ft. scale model of S.S. *Queen Elizabeth* the property of the Cunard Steamship Company, has been exhibited in the chief showrooms of the Eastbourne Gas Company. The model is mounted in a glass case on a road trailer, is insured for £10,000, and weighs 6 cwt.; as regards floor strength, however, it was necessary to allow for an overall weight of 10 tons, including an allowance for the people viewing the exhibit. In order to get the model in and out, it was necessary to remove the showroom window. The exhibition, which was for the benefit of the funds of the Merchant Navy Comforts Service, was opened by the Mayor of Eastbourne. It attracted great interest and there was a continuous stream of visitors of all ages to inspect the model. As a result, the funds of the Merchant Navy Comforts Service have benefited by the sum of £178.

The Simmonds Group was, in 1938, the first large organization in the light industries to respond to the Government's appeal to establish themselves in the special development areas, and as an experiment arranged for the construction of a large modern factory outside Cardiff. Since then the factory has been increased in size several times until during the war some 4,000 workers were employed. The Group, with eight years' comparative statistics of manufacturing in South Wales and in London, has reached the conclusion that for its light industrial manufacture, South Wales under present conditions is as suitable an area as London, and in the light of national policy it has decided to close the Great West Road Works and concentrate its light manufacturing at its Treforest Works, where already throughout 1946 the major part of its production took place. As from Feb. 1 Simmonds Aerocessories, Ltd., will have moved to Treforest both its head office organization and its research departments now at the Great West Road. The London offices at 2 and 3, Norfolk Street, Strand, and the regional offices are unaffected by this change.

Approval has Been Given by the Board of Trade to the change of name of the Hewitt Construction Syndicate, Ltd., to Hewitt Construction, Ltd., as from Jan. 24.

A Party of German Commercial Scientists, controlled by the British Intelligence Service, have arrived in London, and are living at a mansion at Hampstead.

A System of Priority based on date of application is to be adopted by the Clitheroe Gas Department in connexion with the resumption of the hire purchase of gas appliances. Terms for hire purchase are now under consideration.

For the First Full Post-war Meeting of the British Association, to be held in Dundee next autumn, the Council has adopted a general theme: "Swords into ploughshares." Prominence will be given in the sectional programmes to the positive contributions which science has made, and can make, towards the well-being of mankind.

A Sound Film entitled "The Smith at Work" has been produced by Thomas Smith & Sons (Rodley), Ltd., to demonstrate the full range of the Company's products. The commentary is by Mr. Frank Phillips, the B.B.C. announcer, and the background music is by the London Symphony Orchestra. Copies of the film are available on loan to technical associations.

The Gas Supply Position in Dublin has been critical recently and the Alliance and Dublin Consumers' Gas Company has told the public that the use of gas must be reduced voluntarily or the Company will be forced to cut the present "on" hours. The difficulties in obtaining fuel are increasing, the Company states, but if the public co-operates, the crisis will be passed.

Gas Pressure at Glasgow was reduced last week, as a result of the failure of the supplies from the two coke oven sources—Bairds, at Gartsherrie, and Dixons, at Glasgow. The faults that caused the cuts at both sources have been rectified. Dixons are already back to their normal supply, and Bairds returned to normal the following day. Despite the cut, 43,500,000 cu.ft. of gas went out on Thursday, which was about the average for a cold spell.

Grave Concern is Being Felt by the Shrewsbury Lighting Committee at the serious extent to which malicious damage to street lamps has increased since August, when general street lighting was resumed after the summer months. Over 600 panes of glass have been broken in gas lamps alone since that date, and owing to the long delay in getting replacements many of the lamps are out of service. The Committee proposes to conduct a campaign calling on the public to assist in any way they can, such as reporting offenders to the police as soon as possible. It is also proposed to circularize schools and military establishments. The Watch Committee has agreed that special attention should be given to the matter by the police.

The Address of the London Regional Office of the Ministry of Works is now 8, Cornwall Terrace, Regents Park, N.W.1 (Telephone: Museum 5030. Telegraphic address: Travauxreg, Norwest, London). The following sections are at the new address: Principal Officer (except Contracts and Finance); Regional Progress Officer; Regional Disposals Officer; Assistant Regional Director (Controls); Local Authority Liaison; Regional Allocation Officer; Regional Materials Officer; Assistant Regional Director (Production of Materials); Regional Programme and Statistics Officer; Regional Works Transport Officer; Regional Road Motor Engineer. The address of Regional Licensing Officer is 17, Cornwall Terrace, Regents Park, N.W.1. The Regional Production Officers, Messrs. Catto & Nickson, are also at Cornwall Terrace. The following sections remain temporarily in the City: Candlewick House, Cannon Street, E.C.4 (Mansion House 3477): Area Directors: Contracts and Finance; Temporary Housing Architects; Regional Quantity Surveyors; Regional Distribution Officers. 9-13, King William Street, E.C.4 (Mansion House 4353): D.L.A. (Temporary Housing); Regional Works Engineer (Structural); Regional Works Engineer (M. & E.). The District Office staffs who have been working in association with the Regional Architect, Ministry of Health, at Hackney, Kingston, and Beckenham, have moved to Cornwall Terrace, Regents Park.

Price Increase

Notice was given to gas undertakings on Jan. 31 by a number of manufacturers of gas appliances announcing that as the result of an investigation on the increased cost of materials and awards to labour it had been found necessary to advance the current prices of domestic gas cooking appliances and components by 7½%. The new selling prices came into force on Monday.

The companies concerned are: General Gas Appliances, Ltd., Radiation, Ltd., Stoves, Ltd., and the Vulcan Stove Co., Ltd.

General Gas Appliances, Ltd., further announced that the price of the "C.R." convector radiant gas fire would be advanced by 10% from the same date.

The Gas Industry *vis a vis* The Coke Oven Industry

[From a Special Correspondent]

ONE of the main reasons why coke ovens have not been applied generally by the Gas Industry is bound up with the costs which have to be incurred in the provision of the expensive machinery ancillary to them. Whether the oven plant is large or small this machinery cannot be altered to any marked extent. Where the basic demand for gas is large enough and where the quality of the gas produced and of the coke made is suitable the installation of coke ovens may be considered by a gas undertaking, but there are few undertakings where these conditions hold.

E. G. Stewart[1] has shown that in this country a coke oven plant cannot be operated economically in comparison with other types of carbonizing plant unless its capacity exceeds 1,000 tons of coal per day. It is necessary to install a plant of such capacity in order to secure economy in labour and to prevent the high capital cost of machines, coke quenching plant, coke wharf, coal plant and bunkers, &c., acting as a deterrent.

Some interesting comparisons of the capital and process costs of different types of carbonizing plant have been given by R. W. Hunter[2] in describing the coke oven plant at Beckton Gas-works.

Yields per ton of coal	Horizontal retorts	Continuous vertical retorts	Intermittent vertical retorts	Coke ovens
Gas, therms ...	74.5	80	80	74.5
Coke for sale, cwt.	10.32	10.01	10.12	11.31
Breeze for sale, cwt.	1.88	1.50	1.54	0.83
Tar, gall.	9.42	10.1	11.70	9.02
Capital cost per ton of coal per day...	£260	£249	£262	£279
Net costs per ton of coal carbonized	11s. 5.1d.	10s. 10.7d.	10s. 7.7d.	10s. 4.4d.
Net cost per therm of gas made ...	1.840d.	1.634d.	1.569d.	1.669d.

These costs have been arrived at after crediting the gross charges with the saleable by-products and with the value of the waste heat steam generated.

It is of interest to note that the charges for labour are considerably lower for coke ovens than for any other type of carbonizing plant, being 16d. for horizontals, 13.7d. for continuous verticals, 10.6d. for intermittent verticals, and 8.7d. for coke ovens. These costs would be considerably greater to-day, but they reflect the small amount of labour required on coke oven plants.

Requirements

In general, the Gas Industry requires plant which is suitable for the coals available and which is flexible under strict demands of quality and quantity. As the plant is usually situated on land of a relatively high value, it should occupy the least ground space per unit of gas output and it should cause little interference with local amenities. The coke produced should be readily saleable in or near the area of gas supply. These conditions should all be met and at the same time the plant should be capable of giving the cheapest gas.

In the Gas Industry, although undertakings commenced on a new site in the first instance, the works first installed were only required to meet a demand for gas which was a fraction of the demand to-day. These works, too, were built many years ago and consequently gas undertakings have, in the course of their history, both extended their works and re-built several times, possibly on a site of limited extent. As a result very often gas-works plant fails to present an orderly appearance and the process is carried out with an intermingling of the old and the new. Very often it is impossible to carry out a major re-organization without interfering with the constancy of gas supply.

The primary incentive for building a coke oven plant may be to make coke to supply an existing demand or one which is being created at the time the plant is being built. Thus an oven plant may be built in the neighbourhood of blast furnaces in order to meet the needs of the latter. Alternatively, the object in building a coke oven plant may be to provide an outlet for the less saleable slacks produced at a colliery by upgrading them through carbonization at high temperatures. Whatever the reason the capacity required of the plant is generally fairly well defined in the first instance and, therefore, the plant may be planned and laid out with certain well defined requirements in mind. Once the plant has been built alterations and additions are not normally to be expected at least for a number of years, but a site which has been well planned will always be so arranged that any additions can be made in a tidy and orderly manner.

Some interesting comparisons of the ground space occupied by various types of carbonizing plant have been given at various times by E. G. Stewart[1], by T. Hardie[3], and by F. B. Richards[4]. The following table given by the last named indicates that the continuous vertical retort is the most economical in ground space except in the smallest of installations. Batteries of coke ovens at slightly over the lowest comparative economic size to the Gas Industry require more ground space than any of the other types of carbonizing plants of reasonable daily capacity.

Type of installation	Total output therms per day	Total sq.ft. of ground space occupied	Therms per day per sq.ft. of ground space
Inclined retorts	22,338	19,500	1.15
Horizontal retorts	34,560	23,400	1.48
Continuous vertical retorts ...	50,388	14,212	3.55
	46,670	13,300	3.50
	42,028	13,230	3.18
	31,200	11,520	2.71
	19,890	7,326	2.72
	5,724	2,580	2.22
	1,210	950	1.27
Intermittent vertical chambers ...	45,060	18,914	2.37
	34,040	14,432	2.36
	20,780	9,388	2.21
	1,920	1,830	1.05
Coke ovens	85,200	91,800	0.93
	84,500	62,200	1.35

The ground space occupied by the carbonizing plant includes the necessary ground round it for access and provides for retort or chamber bench, producers, waste heat boilers, quenching towers and that portion of the coal and coke handling plant within the confines of the retort house. In the case of coke oven plant the ground space includes that required for the operation of the battery (pusher ram clearance, coke wharf, &c.), and that necessary for a mechanical producer plant for heating the ovens.

[1] E. G. Stewart, The Functions of Coke Ovens, Trans. Inst. Gas Eng., 1929-30, 79, 660.
[2] R. W. Hunter, Trans. Inst. Gas Eng., 1932-33, 82, 845.
[3] T. Hardie, "GAS JOURNAL," 1927, 178, 34.
[4] F. B. Richards, Trans. Inst. Gas Eng., 1937-38, 87, 841.

(*To be continued.*)

Furnaces For Steelmaking

(A "GAS JOURNAL" Abstract)

On Jan. 15 Dr. J. H. Chesters and Mr. M. W. Thring gave a Paper to the Yorkshire Section of the Institute of Fuel based largely on the result of the U.S.-B.C.U.R.A. trials which have been fully reported in the Iron and Steel Institute Special Report No. 37. The introduction discussed possible lines of development—including the use of oxygen. An historical note traced the development of the open-hearth furnace. There were comments on the thermodynamics of steelmaking using the expression "virtue" to describe the quantitative evaluation of heat at different temperatures. The fact that the Bessemer process, in which "the heat from the materials in the charge is provided right inside the steel," has not been able to hold its own against the Siemens process "in which heat is put in from the outside, shows that fuel economy has not been the predominant factor in deciding how steel is made." The present trends in fuel costs may alter this decision.

Research takes three forms: (1) In a small-scale experimental furnace under the complete control of the investigator; (2) "the operation of a prototype full-scale furnace under fully controlled conditions of actual steelmaking"; and (3) "the investigation of a number of furnaces in commercial operation." The investigations discussed in the Paper were on the last-named lines.

A point of interest to the gas engineer is the detail of a refractory concrete venturi orifice built into a producer gas flue to measure the flow of hot gas; a drawing of this was given. The importance was stressed of adequate instrumentation to secure the best results. For instance, an operator can afford to run his roof "more steadily at the limiting safe temperature," affecting the downward heat-flow enormously," if the roof is equipped with a pyrometer.

New South Wales Statistics

We have received from the Department of Local Government, Gas Examination Branch, Sydney, copies of the Annual Analyses of Production and Distribution Costs and of Selling Prices for the 37 gas undertakings in New South Wales for the two years 1943 and 1944. The statistics for 1943 relate to 18 municipal and 19 company undertakings, and for 1944 the figures are reversed, the Dubbo undertaking having been transferred from a Company to the Municipality.

Although in some instances there were slight decreases in the quantity of gas made in 1944 compared with 1943, there was a general increase in gas sales. The largest undertaking is that of the Australian Gas Light Company, which made 10,149,322,000 cu.ft. of gas in 1944 compared with 10,439,150,000 cu.ft. in 1943, and sold 9,615,692,000 cu.ft. in 1944 as against 9,443,501,000 cu.ft. in 1943. Consumers increased from 293,581 to 299,182. Later returns give the present total as 303,000. The average price received for gas sold rose from 66.4d. in 1943 to 67.2d. per 1,000 cu.ft. in 1944. Corresponding statistics for the second largest undertaking, the North Shore Gas Company, are: Gas made, 1943, 2,161,621,000 cu.ft.; 1944, 2,536,539,000 cu.ft.; gas sold, 1943, 1,839,914,000 cu.ft.; 1944, 2,193,712,000 cu.ft.; consumers, 1943, 59,562; 1944, 60,492 (latest returns, 60,956); average price, 1943, 61d.; 1944, 60.6d.

The smallest undertaking in the list is that of the Molong Corporation with 150 consumers (to-day 163). Gas make decreased from 3,020,000 cu.ft. in 1943 to 2,861,000 cu.ft. in 1944, but sales increased from 1,767,000 cu.ft. to 1,788,000 cu.ft., and average price received fell from 137.8d. to 131.6d. Kiama Gas Company recorded a make of 3,680,000 cu.ft. in 1944 against 3,496,000 cu.ft. in 1943, and total sales of 3,273,000 cu.ft. against 2,990,000 cu.ft. Consumers increased from 167 to 200, and average price rose from 129.5d. to 130d. According to the latest figures consumers have fallen to 189

A Simon Veterans' Party

Sir Ernest Simon, M.Inst.C.E., M.I.Mech.E., Governing Director of Henry Simon, Ltd., and Simon-Carves, Ltd., recently invited all members of the Simon Companies with 40 or more years of service to lunch with him and Lady Simon at the Midland Hotel, Manchester. Nearly 40 guests assembled; they included not only those still active in the Simon engineering works and offices, but also a number of retired members with exceptional service records and several of the present Directors, including Mr. R. B. Potter, Chairman of Simon-Carves, Ltd., and Mr. C. Bentham, Chairman of Henry Simon, Ltd. Nearly 30 of those present were "forty-year veterans" and more than a score of them are still at work.

Addressing his guests after lunch, Sir Ernest remarked that it was a unique gathering of old friends representing three generations of the Simon business. Mr. Arthur Stanley, former Managing Director of Simon-Carves, Ltd., joined in 1883 as personal Secretary to the late Henry Simon, father of Sir Ernest and founder of Henry Simon, Ltd., and Simon-Carves, Ltd., and is the last surviving member of Henry Simon's personal staff; he retired in 1936 after 53 years' service

Some of the Simon veterans.

and is still a member of the Board of Simon-Carves, Ltd. The record for long service is held by Mr. J. Ingleby, of the milling engineering staff of Henry Simon, Ltd., who also joined in 1883 and is still at work after no less than 63 years.

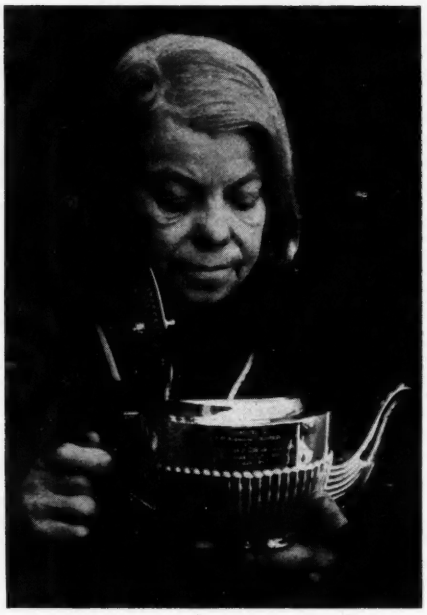
In a short review of the history of the Simon firms Sir Ernest said that in 1883, shortly after his father had built the first complete roller flour mill and the first by-product coke ovens in Britain, the whole business employed 14 people. In 1910 when Sir Ernest became Chairman, the number had risen to 350, and to-day nearly 4,000 are directly employed, most of them at Cheadle Heath, the remainder being abroad in various parts of the world.

In the first generation of their history, Sir Ernest continued, his father had established his two businesses on solid foundations, leaving each of them in a leading position in its own sphere. In the second generation the two firms and their several subsidiaries forming the Simon Engineering Group had expanded ten times over, and he now looked forward with the greatest interest and confidence to what they would achieve in their third generation.

Lady Simon and Mr. Bentham also addressed the party, and replies on behalf of the "veterans" were made by Mr. Stanley and by Mr. G. M. Anderson, who joined the milling engineering staff of Henry Simon, Ltd., 43 years ago.

Long Service Rewarded

Eight employees, three women and five men, of Gibbons (Dudley), Limited, received presentation on Jan. 25 in recognition of their long service. Each of them has been with the firm for over half a century, their total length of service being 432 years.



Mrs. Rosannah Thompson, one of the recipients, is seen admiring her newly acquired silver teapot. She is still working in the brickyard and has been with the Company for 55 years.

The presentations, silver teapots for the three women, and gold watches for the men, were made by Mrs. Gibbons, wife of Lieutenant-Colonel W. E. Gibbons, O.B.E., T.D., J.P., Chairman of the Company, in the works canteen at Lower Gornal, Worcestershire.

Barber's Shop in a Nissen Hut

A hairdressing establishment recently opened at Coventry consists of an Army type Nissen hut erected in the centre of the city as a temporary building measure.

The heating of the establishment is entirely by Bratt Colbran overhead heaters and the water heating installation is by three Ascot multipoint water heaters. Each set of cubicles has a gas-heated towel warmer.

The installation has caused considerable comment among owners of similar temporary buildings, and the number of enquiries received by the Coventry Gas Department suggests that considerable additional business will result.

Economic Policy for 1947

[From a Special Correspondent]

THE recent publication of the White Paper on "The Economic Considerations Affecting Relations Between Employers and Workers" is perhaps somewhat overdue in its appearance, but it is nevertheless one of the most opportune documents which have yet been issued on domestic affairs. The gravity of the situation in which we now find ourselves is not coloured by undue pessimism, but is an expression of the realities which will have to be faced in the near future. For unless there is a radical change in the attitude of the majority of the members of the nation to their work and a complete understanding of the vital importance of individual effort, then Britain will cease to have any influence in the affairs of Europe or the world. During the war we pulled the extra ounce of national effort out of the bag when it was most needed, but to-day there appears to be no reserve forthcoming in some spheres of activity. It is not only useless but dangerous to sit back and hope that a miracle will happen and that everything will turn out all right in the long run. This time there are no allies to come to our aid—only competitors in a struggle for world markets.

A Crisis to be Overcome

However, if the people of Britain realise *now* the nature of the crisis which they are facing, and provided they face it honestly and sincerely, then the difficulties may be overcome. The problems as they occur and are reported from time to time in the Press are confusing in their detail and presentation, and there is no wonder that many throw up their hands sometimes, and despair of ever arriving at an understanding of them. The next step is to cast the responsibility of solution on some official body or organization, and in the last resort on "them"—the Government. It is not to be assumed from this state of affairs that we as a nation suffer from an innate lack of a sense of responsibility; rather is it an indication of the need for wider publication in easily accessible and readable form of statements on the issues in question. The following notes, written before the publication of the White Paper are an attempt to discuss some of the major points in our economic policy.

An Artificial Position

Behind the Babel of party voices and opinions overwhelming us with arguments and counter-arguments stands the grim reality of the artificial position in which we find ourselves. Even before the war we were not paying our way in international trade, but we did have roughly £1,000 million of credit and investments abroad on which we could, and did, draw. That reserve has now gone, but we still contrive to maintain a standard of living which cannot be continued on the existing economic structure. True, there are the American and Canadian loans which are intended to tide us over the difficult period of reconstruction, but with rising prices in the U.S.A. the value to this country of the line of credit has been seriously diminished. Moreover, there are grave doubts being expressed as to the length of time the loan will last. As far as exports are concerned, Britain is still not in a position to be able to pay for all the imports, and her commitments, however ethically and internationally necessary they may be, are an additional drag on her powers of recovery.

This situation is bad enough, but it appears even graver when we consider the almost unique position of Britain in relation to food supplies. She alone, of all the major industrial countries, has no large agricultural reserve within her boundaries. Whatever happens to international industry and trade, Britain must import food on a large scale or starve. The only way we can pay for such vital commodities is with exports. It follows, therefore, from the last paragraph that our present standard of living, however inadequate or unsatisfactory it may appear to be compared with our pre-war conditions, is nevertheless artificially high and cannot be maintained indefinitely without a very substantial increase in exports. The question then is, are we willing to accept a lower standard of life, and if not, what can be done to improve the position?

It is easy enough to set an export target for a country, but it is a totally different matter to ensure its achievement, for here the simple fact remains that there must be both a suitable market and a willing buyer. The days when food producing countries gladly exchanged their crops for manufactured goods are rapidly dying out; most of them were forced to develop their own manufacturing industries when war-time difficulties of transport interrupted the flow of goods to them. The present heavy overseas demand for British machinery is a sufficient pointer to the new industrial set-up which we can expect in the future. Moreover, growing populations in Australia, New Zealand, and Canada alone are resulting in an increased drain on home produced foodstuffs and cereals in particular. The old order has changed and cheap bargains on which much of our previous prosperity was built must give way to dearer imported food, and consequently a reduction in our consumption or an increase in exports. This is the vicious circle. Furthermore, the newer industrial countries may soon find themselves in a position to export manufactures to the remaining non-manufacturing countries, thus embarrassing (temporarily, at least) the British export trade. It is useless to argue that this country can stop the apparent self-destruction of its export trade by prohibiting the overseas sale of machinery. Industrial and economic progress is dynamic, and such change is inevitable.

Britain Must Export

The position, therefore, is that somehow or other, Britain must export, but one of the conditions laid down earlier was that there must be a willing buyer. This raises the next major question of competition in a world market, and costs of production are one aspect of that competition. We have seen that the raw material, food, for the human agent of production is likely to remain at a higher level or price than before the war. Other things being equal, it follows that any compensating reduction in costs in order to enable us to compete on favourable terms with other producers must be met by increased efficiency on the part of all the factors of production—in other words, by increased output. There is probably too little real information on production-per-man-hour to warrant many of the generalizations often made against employers and employed, and for that reason alone it would be in the interests of the country as a whole if more investigations were set afoot in this line of study. However, the argument for the need to improve production still stands, and the means of achieving it are subsidiary to the larger problem now facing us—*viz.*, can we afford not to do so? If sectional interests are given priority over the national interest during the next two or three critical years, then any possible opportunity of recovery will be lost and no section of the population will have any chance of gaining material benefit.

The Social Aspect

Perhaps the more significant aspect of the situation is the social and psychological one, although this is closely related to the economic background just discussed. There can arise in a country or community such a paralysis or inertia that even though danger threatens the people are powerless to resist the menace. It may be due to weariness, apathy, or to a state of hypnotism produced by the magnitude and nature of the very danger itself. Whatever the cause or combination of causes may be, this paralysis must be resisted at all costs. One expression of this attitude is the numerous forms of selfishness which have made their appearance in the last two decades; and it is just too easy to fall prey to a suggestion that if we, as individuals, do not take advantage of some anti-social opportunity, others will be only too quick to make a mockery of our principles. Black market practices thrive in such an atmosphere and pave the way for large scale interference with the Government plans for equitable distribution of resources.

Viewed from another angle, all this is indicative of a decline from the old standards of public morality and sense of responsibility, but the people are not entirely to blame. For years now there has been a parade of slogans which

emphasized the duty of the State towards its citizens but omitted to point out the complementary duties to the State. For instance, little was said of the price which must be paid for every demand for State assistance, and that this price takes the form of either taxation or controls, or both. This is not to deprecate all that has been done and is planned for these people in increasing benefits of social services, many of which are overdue, but the alternative which now confronts us ought to be made clear and understandable to the electorate. If the people of Britain wish the State to take over what were originally personal responsibilities, then these services must be adequately financed out of our available resources—in short, out of production. The corollary is equally significant. If the drain on production is not to be crippling, then the price which must be paid is in increased efficiency and output with lower costs of production for the goods manufactured.

A Universal Problem

Here, then, is a problem which affects every employed person. On the one hand, there are day-to-day demands for shorter hours, longer holidays, and increased wages, all of which if carried beyond a very critical limit, will tend to reduce production or to increase costs. On the other hand, there is an insufficiency of labour at the moment in many of our staple industries, and those who are in employment are becoming heartily sick of pamphlets and speeches in which they are exhorted to work harder. With some justification they point to the alarming growth of the army of Central and Local Government officials and argue that they, the producers, are carrying an unwarranted load of non-producers on their backs. It seems fair to agree that the administration of the country is taking more than its fair share of the labour force, but what is not fully realized is that no system of social benefit schemes can be planned or operated without such officials and "non-producers." This is another and less obvious part of the price to be paid. We cannot have it both ways. In view of the present labour shortages, it is a moot point whether the raising of the school leaving age this year is justified in that industry is robbed of thousands of potential entrants. The gains from the extra year are likely to be less than might be legitimately anticipated because of the inadequacy of the buildings and shortage of staff, books, and equipment. In other words, we may get an inferior education, and the price to be paid for it in terms of national effort will then, to say the least, be uneconomically high.

Vague Ideals

If this analysis is criticized because of its pre-occupation with making the country pay its way, with an apparent lack of idealism and a concentration on the mercenary aspect of the problem, then our answer must be restated in the following terms. There has been too much emphasis in the inter-war years on vague ideals without sufficient recognition of the practical problems involved. To-day there is no time for day-dreaming and airy theorizing; the reality of our position must be made known, understood, and then tackled with the most intensive application of all our resources, both material and spiritual. In times of war the old-fashioned virtue of duty and self sacrifice is recognized and applauded, and responsibilities are accepted without counting the personal costs of inconvenience. The final question, therefore, it: "Can we afford, as individuals, and as a nation, to abandon our sense of responsibility, and if so, are we willing to take the consequences without complaint?" Can the citizens of Britain answer honestly in any other way than "NO?"

World Power Conference Activities

After 23 years at 36, Kingsway, W.C.2, the Central Office and office of the British National Committee of the World Power Conference have removed to new and more commodious premises at 201-202, Grand Buildings, Trafalgar Square, W.C.2. Telephone: Whi. 3966.

National Committees and Representatives

The first post-war edition of the "List of National Committees and Representatives" has been issued and copies are now obtainable from the Secretary of the International Executive Council, Mr. C. H. Gray, at the above address. As the List shows, there are at present 26 National Committees, and seven other countries possess accredited representatives, giving a total of 33 member-countries. This compares with 44 member-countries in 1939. The reduction is partly accounted for by the fact that ex-enemy countries are not at present eligible for membership of the Conference, and partly by the fact that certain pre-war member-countries (*e.g.*, the Baltic States) have ceased to exist as independent States. It is also noticed that certain of the National Committees are described as "at present in course of reconstitution." Nevertheless, it is remarkable that the Conference should have been successful in re-building its organization so quickly after the end of the war. In addition to the particulars of the organization of the World Power Conference the List provides a convenient source of information as to the most important organizations and personalities in the fields of power and fuel.

Membership of the Great Britain Committee is as follows:

Chairman—Sir Harold Hartley, K.C.V.O., C.B.E., F.R.S. (Individual Member).

Vice-Chairman—Mr. Harold Hobson (Representing the Central Electricity Board).

Honorary Treasurer—Colonel C. M. Croft (Representing the Institution of Gas Engineers).

Honorary Secretary—Mr. C. Rodgers, O.B.E. (Individual Member).

Members—Mr. J. R. W. Alexander, Representing the British Gas Council; Sir Hugh Beaver, Representing the Institution of Chemical Engineers; Mr. A. W. Berry, Representing the British Engineers' Association; Brigadier D. Harrison, C.B., D.S.O., Representing the War Office; Dr. H. G. Colman, Representing the Institute of Chemistry of Great Britain and Ireland; Mr. V. W. Dale, Representing the British Electrical Development Association; Sir C. G. Darwin, F.R.S., Representing the National Physical Laboratory; Mr. W. J. Drummond, Representing the Mining Association of Great Britain; Mr. L. N. Duguid, Representing the Ministry of Labour and National Service (Factory Inspectorate); Mr. J. Eccles, Representing the Incorporated Municipal Electrical Association; Mr. P. A. H. Elliot, Representing the Combustion Appliance Makers' Association (Solid Fuel); Mr F. C. Faraker, Representing the Commonwealth of Australia; Mr. C. S. Garland, Representing the Society of Chemical Industry; Dr. F. H. Garner, O.B.E., Representing the Institute of Petroleum; Mr. N. G. Gedye, O.B.E., Representing the British Committee of the International Commission on Large Dams of the World Power Conference; Sir Charles Goodeve, O.B.E., F.R.S., Representing the British Iron and Steel Federation and the British Iron and Steel Research Association; Mr. W. S. Graff-Baker, Representing the Institute of Transport; Mr. A. Robertson, Representing the Institute of Marine Engineers; Sir William Halcrow, Representing the Association of Consulting Engineers; Mr. Ranald J. Harvey, Representing the Government of New Zealand; Professor Douglas Hay, M.C., B.Sc., Representing the Institution of Mining Engineers; Mr. A. Hittinger, Representing the National Benzole Association; Mr. W. J. Jones, Representing the Electric Lamp Manufacturers' Association; Sir J. M. Kennedy, O.B.E., Representing the Electricity Commission; Eng. Vice-Admiral Sir J. Kingcome, K.C.B., Representing the Admiralty; Dr. C. H. Lander, C.B.E. (Individual Member); Dr. R. Lessing, Representing the Institute of Fuel; Dr. W. A. Macfarlane, Representing the Ministry of Fuel and Power; Sir George Nelson, Representing the British Electrical and Allied Manufacturers' Association and the Federation of British Industries; Dr. A. Parker, C.B.E., Representing the Department of Scientific and Industrial Research; Sir Clifford Paterson, O.B.E., F.R.S., Representing the British Standards Institution; Sir Leonard Pearce, C.B.E., Representing the Institution of Civil Engineers and the Institution of Mechanical Engineers; Colonel Sir Thomas Purves, O.B.E., Representing the Cable Makers' Association; Major H. Richardson, M.C., Representing the Incorporated Association of Electric Power Companies; Mr. D. Rider, O.B.E., Representing the Society of British Gas Industries; Sir Ewart Smith, Representing the Association of British Chemical Manufacturers; Sir E. W. Smith, C.B.E. (Individual Member); Mr. T. B. Symmonds-Babb, Representing the Air Ministry; Mr. W. Neville Warwick, Representing the Coke Oven Managers' Association; Sir Johnstone Wright, Representing the Institution of Electrical Engineers.

Fuel Economy Conference

The arrangements for the next Sectional Meeting of the World Power Conference are well in hand and an impressive collection of British contributions to the Conference will be presented. Full particulars of titles, subjects, and authors will, we are informed, be released shortly.

The Purging of Gas Plant and Holders*

By L. SILVER, B.Sc., A.R.C.S., D.I.C., A.R.I.C., M.I.Chem.E.

(Gas Light and Coke Company)

THE practice of purging holders, large mains and other equipment of considerable gas capacity with an inert gas before putting them into or taking them out of service, is a safety precaution the wisdom and advisability of which no responsible gas engineer would question, even under present conditions of relative security. What is merely a wise precaution in these times became an absolutely essential one in all vulnerable areas during the war period, when also damage due to enemy action multiplied the number and variety of occasions when purging became necessary. The special conditions and difficulties created by the incidence of war damage required the exercise of much ingenuity in the improvising of rapid and unorthodox methods. Thus a much wider experience of the practice is now available for discussion than existed, say, six years ago.

Purging with inert gas has been a regular routine operation in the United States for a longer period than in this country, and some of the methods in use here have been copied from American practice. The case for purging and a description of methods were presented to the American Gas Association in 1932 by H. W. Alrich (*A.G.A. Proceedings*, 1932, p. 827), and an excellent paper on "Theoretical and Practical Considerations in Purging Practice" was read in 1934 by S. S. Tomkins (*A.G.A. Proceedings*, 1934, p. 799), while in 1933 the A.G.A. issued a code of procedure for the purging of gas holders. In 1937, Mr. A. S. Lee described to the Southern Association of Gas Engineers and Managers the use of a home-made inert gas machine for purging holders, scrubbers and purifiers, and in the same year Mr. F. M. Birks (*Transactions Institution Gas Engineers*, 1937-8, p. 405) described the use of the Harrison purging machine in a paper which provoked an interesting discussion, revealing that even at that date there was still some division of opinion among gas engineers on the necessity for purging with inert gas when putting holders into or out of commission.

Explosive Mixtures

The purpose of purging with inert gas is, of course, to prevent the direct admixture of air and combustible gas at any time during the replacement of one by the other, in order to avoid the possibility of explosion. Some consideration is therefore necessary of the composition and properties of explosive mixtures of gas and air, and of the effect on explosivity of the admixture of inert gases with either constituent.

Any combustible gas, when mixed with certain proportions of air, will form explosive mixtures in which flame or explosion will be propagated throughout the mass from any point of ignition. If air is added in gradually increasing proportion to a combustible gas the mixtures first formed, containing a relatively small proportion of air, will not themselves be explosive, although they may, of course, be ignited at any point where they issue into the atmosphere and will then burn. As the proportion of air is increased a point is reached at which the mixture becomes explosive when ignited; with further increase in the air content the mixture remains explosive over a wide range of composition, until with the progressive diminution of the proportion of combustible gas the mixture becomes too weak to explode or even to inflame. The limits of composition between which the mixture is explosive, expressed as the percentage of the combustible gas in the mixture, are known as the upper and lower limits of inflammability, or more briefly, as the explosive limits for the particular gas and air.

The direct replacement of gas by air or of air by gas cannot be brought about without some degree of mixing by diffusion and convection; hence, in the boundary zone between gas and air the composition of the mixture passes progressively through every proportion from 100% of one to 100% of the other. It follows that in some parts of the zone of mixing the composition lies between the limits of inflammability, so that the mixture is explosive. Hence direct replacement can never be carried out without some risk, however slight, of mishap by the ignition of this explosive mixture. In the purging process this risk is eliminated by first replacing the contents of the holder with an inert gas, and then replacing the inert gas by the other constituent of the explosive mixture. In the interests of economy of materials and time the replacement is never taken to completion. It is therefore necessary to study the effect of added inert gases on the explosive limits.

Limits of Inflammability

The subject of limits of inflammability of gases and vapours has been treated very exhaustively by Coward and Jones in Bulletin No. 279 of the United States Bureau of Mines, and the discussion below is based on their reports.

The limits of inflammability in air are characteristic of the combustible gas. They are fairly sharply defined, but are influenced to some extent by the containing vessel and the mode of ignition. Thus the explosive range is wider for upward propagation—*i.e.*, when the mixture is ignited from below, than for downward propagation. This is to be expected, since the hot products of combustion tend to convect the flame upwards. Also, the range is rather wider for large vessels than when the gas is confined in relatively narrow tubes where cold surfaces may have a quenching effect. The values quoted in this paper for use in purging practice are all for upward propagation in wide vessels.

If oxygen is substituted for air the lower limit is, in general, little affected, but the upper limit is considerably increased. This is to be expected for, at the lower limit, there is always, even in air, more oxygen present than is required for complete combustion, but at the upper limit there is very much less oxygen than the gas requires for its combustion.

The lower and upper limits of inflammability in air of the various combustible constituents found in fuel gases, as determined by Coward and Jones, are given in Table 1.

TABLE.—*Limits of Inflammability for Pure Gases*

Gas	Lower limit %	Upper limit %
Hydrogen	4.0	74
Carbon monoxide	12.5	74
Methane	5.3	14
Ethane	3.2	12.5
Ethylene	3.0	29
Propane	2.4	9.5
Propylene	2.0	11.1
Benzene	1.4	6.7

It will be noted that, with the exception of carbon monoxide, a very low percentage of any of these gases is required to form an explosive mixture, and that, excepting for hydrogen and carbon monoxide, any explosive mixture contains more air than gas. Hydrogen has much the widest range of explosibility, and is followed by carbon monoxide.

Calculation of Explosive Limits

For complex combustible gases such as coal gas, water gas or town gas, the limits may be measured in the same way as for the pure gases. This has been done for a large number of industrial mixtures, but, since the composition of these mixed gases is highly variable, such data must have very restricted application. It is, therefore, more convenient to calculate the limits for such mixtures from the limits for their individual constituents. The method of calculation is based on a rule due to Le Chatelier, which is based on the hypothesis that if lower limit mixtures of different combustible gases and air are mixed with one another in any proportions the resulting mixtures are themselves at their lower limits of inflammability. The same applies fairly well to upper limit mixtures. Some exceptions

*Paper to the Southern Association of Gas Engineers and Managers (Eastern District), Jan. 28.

to this rule are known, but they concern gases other than those we are considering here.

Hence, to calculate the lower or upper explosive limit for a mixture of combustible constituents, such as air-free coal gas, we have to assume that each constituent, in the proportion in which it is present, is associated with the appropriate proportion of air to make the corresponding limit mixture, the total amount of air associated with the combustible mixture at its limit being the sum of these. The effect of inert constituents in the mixture is dealt with later. The formula expressing this rule may be simply written:

$$\frac{100}{L} = \frac{p_1}{L_1} + \frac{p_2}{L_2} + \frac{p_3}{L_3} + \ldots .$$

Where p_1, p_2, p_3, etc., are the percentages of the combustible constituents in the original air-free inert-free mixture, L is the percentage of this mixture in the limit mixture required, and L_1, L_2 and L_3 are the limits in air for the individual constituents.

Limits calculated in this way have been compared with those empirically determined for given mixtures, and very close agreement is usually obtained.

Effects of Inerts

Our normal fuel gases always contain some proportion of inert constituents, such as carbon dioxide and nitrogen, in addition to the combustible ones. The effect of such inert gases on the limits must therefore be considered. It has been found that the addition of an inert gas to a combustible gas reduces the range of inflammability by bringing the upper and lower limits closer to one another. The greater the proportion of inert gas the shorter the range becomes until, while there is still a considerable proportion of combustible gas present the upper and lower limits coincide so that all mixtures with air are now completely non-explosive. Similarly, by mixing an inert gas with the air added for combustion the range of inflammability with this mixture can be reduced for any combustible gas, until finally the combustible gas, will not inflame when mixed in any proportion with the air-inert gas mixture.

Graphical Representation

The effects of dilution with inert gas on the limits and range of inflammability are most clearly shown by graphical representation of the limit mixtures on some form of triangular diagram. For the benefit of those unfamiliar with this method of representation a rather detailed description will be given of Fig. 1, which shows the explosive limits for hydrogen in air and the effect on these limits of adding increasing proportions of the inert gas, carbon dioxide.

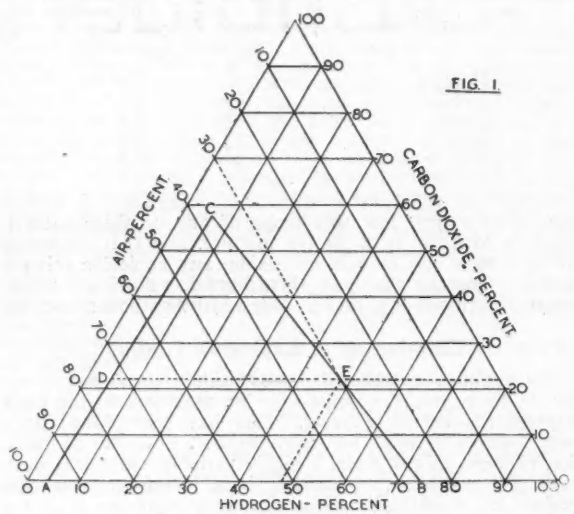


FIG. 1.

The diagram has three sets of graduations parallel to the sides of the equilateral triangle, and dividing these into one hundred parts. The lines running downward from right to left, and numbered along the base, represent percentages of hydrogen ranging from 100% at the right vertex to zero at all points in the left-hand side. Similarly, the percentages of air are indicated by the lines running down from left to right, ranging from 100% at the left vertex to zero at all points in the right-hand side. The horizontal lines indicate the percentages of carbon dioxide increasing from zero at the base to 100% at the apex.

Thus points in the base line denote mixtures of hydrogen and air containing no inert gas. Point A denotes the lower limit mixture containing 4% of hydrogen and 96% of air; similarly, point B shows the upper limit mixture of 74% of hydrogen and 26% of air. The portion of the base line between these two points represents the explosive range for hydrogen in air, any mixture having an intermediate composition and denoted by a point in this line being explosive.

Points in the left-hand side of the diagram represent mixtures of inert gas and air containing no hydrogen, and those

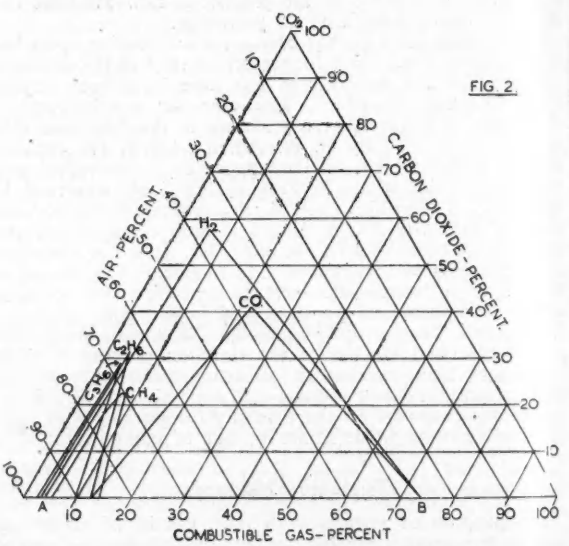


FIG. 2.

lying in the right-hand side denote mixtures of inert gas and hydrogen containing no air. All points in the interior of the graph denote mixtures containing all three components, the percentage of each being shown on the appropriate scale. Thus point E represents a mixture containing 48% of hydrogen, 30% of air and 22% of carbon dioxide. This mixture is at its upper explosive limit, whilst the mixture denoted by point D, which is on the same horizontal and therefore also contains 22% of carbon dioxide, is at its lower limit. The explosive range between these two limits has obviously been shortened by the presence of this proportion of carbon dioxide. As the percentage of carbon dioxide is increased the range shortens still more, points on the lines AC and BC representing the successive compositions of the lower and upper limits as the proportions of carbon dioxide increase, until with 57½% of inert gas the explosive range has shrunk to zero and the upper and lower limits coincide. All mixtures containing more carbon dioxide than this are non-explosive. Any mixture whose composition is represented by a point lying within the triangle ACB is explosive, whilst all points outside the triangle denote non-explosive mixtures.

Fig. 2 shows on a similar diagram the explosive range and limits of inflammability, and the effect of added carbon dioxide on these, for hydrogen, methane, carbon monoxide, ethane and propylene, which may be regarded as the principal combustible constituents of fuel gases. In this diagram the boundaries of the areas of explosibility are in general shown as straight lines; in point of fact, they should be slightly curved, but the curvature is so small that no appreciable error is introduced by this simplification. This is

shown by the graph for methane, which deviates most from the true triangular form and is here shown in its correct shape. Of special interest in the theoretical discussion of purging operations is the apex of the triangle representing the maximum inert content that is compatible with inflammability, and in this connexion the exact form of the sides is unimportant. Table 2 shows the composition of this "limit mixture" for each of the simple combustible constituents of fuel gases with air and nitrogen or carbon dioxide; *i.e.*, the just inflammable mixture with the highest possible inert content.

TABLE 2.—*Limit Mixtures of Pure Gases*

Combustible gas	H_2 %	CO %	CH_4 %	C_2H_6 %	C_3H_8 %	C_3H_6 %	C_4H_{10} %
With added CO_2—							
Combustible gas ...	6.0	22	7.5	4.2	3.7	4.5	3.2
Air	36.5	37	70	64.2	67.3	56.5	67
CO_2	57.5	41	22.5	31.6	29	39	29.8
With added N_2—							
Combustible gas ...	4.8	14	6	3.6	3.0	3.0	2.6
Air	24.2	28	57.5	53	55.4	48	55
N_2	71	58	36.5	43.4	41.6	49	42.4

It will be observed from the diagram and the tables that the hydro-carbons have a much narrower explosive range than either hydrogen or carbon monoxide, and that they require less inert gas to render them non-inflammable. Of the two inert diluents considered, carbon dioxide is more effective than nitrogen, considerably less of it being required to render the mixture non-explosive.

Explosive Limits for Fuel Gases containing Inerts

With the help of the above data we may now apply Le Chatelier's rule to the calculation of the explosive limits in air or fuel gas mixtures containing inert gas. The method usually recommended for making such a calculation is to group the inert constituents with the individual combustible gases in such a way that the limits for these mixtures can be read from the graphs, then to apply the rule to these and to the remaining combustible constituents. Some little skill and ingenuity must be exercised in apportioning the gases for the calculation. The following modification is suggested as being independent of the graphs and easier to apply.

Such a proportion of a principal combustible constituent, e.g., hydrogen, is grouped with all the carbon dioxide as will, with the appropriate air, make the limit mixture as given in Table 2, in the same way the nitrogen is linked with part of the hydrogen. These mixtures are then treated as individual constituents, and Le Chatelier's rule is applied to them together with the remaining hydrogen and the other combustible constituents. An example should make the method clear.

Consider a typical coal gas of the following percentage composition: CO_2 2.1, C_nH_m 3.3, CO 6.6, H_2 52.0, CH_4 28.4, C_2H_6 0.6, N_2 7.0.

Grouping the CO_2 with hydrogen, we find from Table 2 that the limit mixture contains 63.5% of this mixed gas and that the hydrogen associated with 2.1% of CO_2 in such a mixture would be 0.22%. Similarly, the 7.0% of nitrogen is associated with 0.47% of hydrogen in a limit mixture containing 75.8% of mixed nitrogen and hydrogen. For the application of Le Chatelier's rule, therefore, we regard the gas as made up of 2.3% of a mixture of CO_2 and hydrogen with upper and lower limit of inflammability of 63.5%, 7.5% of a mixture of nitrogen and hydrogen with upper and lower limit of 75.8%, the remaining 51.3% of hydrogen, and the other constituents as given above. Thus the upper limit is given by

$$100 \div \left(\frac{2.3}{63.5} + \frac{7.5}{75.8} + \frac{51.3}{74} + \frac{3.3}{11.1} + \frac{6.6}{74} + \frac{28.4}{14} + \frac{0.6}{12.5}\right) = 30.4\%$$

and the lower limit by

$$100 \div \left(\frac{2.3}{63.5} + \frac{7.5}{75.8} + \frac{51.3}{4.0} + \frac{3.3}{2.0} + \frac{6.6}{12.5} + \frac{28.4}{5.3} + \frac{0.6}{3.2}\right) = 4.8\%$$

The calculation of the percentages of air and additional inert gas in the limit mixture of coal gas with nitrogen or carbon dioxide is slightly more involved, but is based on the same principle.

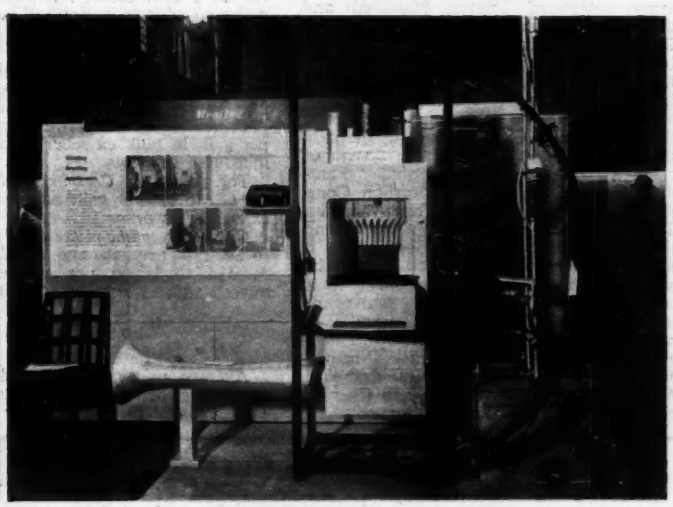
(To be continued.)

Gas Exhibit at Building Science Exhibition

An exhibit which attracted considerable interest at the Building Science Exhibition, Caxton Hall, London (Jan. 13-18), was an illustration of tests carried out on gas appliances.

The Gas Industry display, provided by Watson House in conjunction with the British Gas Council, showed how tests are carried out on a gas cooker for complete combustion, thermal efficiency and perfor-

How cookers are tested at Watson House.



Fuel Research Board test for open coke fires.

The exhibition, organized by the Incorporated Association of Architects and Surveyors, with the co-operation of the Department of Scientific and Industrial Research and many trade research and development associations, was open to the general public, and well attended during its brief run. Its purpose was to illustrate the scientific background of home construction and fuel services.

mance, and the checking of oven temperatures. A number of attractively arranged photographs demonstrated many of the processes through which equipment passes at the testing laboratory before going into service.

The Fuel Research Board organized an exhibit showing the method of testing the efficiency and performance of an open coke fire.